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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

QUACH, TUAN N

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 10/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/627,649

Applicant(s)

SANDHU ET AL.

Examiner

Tuan Quach

Art Unit

2814

-- Th MAILING DATE of this communication appears on the cover sheet with the corresponding address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED. (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 September 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 6-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 6-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 01 September 2003 is: a) ☒ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the certified copies of the priority documents has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 6-9, 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeng '303 singly or with Hyakutake.

Jeng '303 shows conductive lines 62/58/60 on silicon oxide 66 and 64, low k dielectric material 78 located between adjacent lines 58, the upper surface of layer 78 being higher than the upper surface of line 58, and the lower surface of layer 78 being lower than the lower surface of line 58, as shown in Figs. 14-16, column 5 lines 33 to 56, column 6 lines 35-36. The provision of the upper layer of refractory metal nitride

and of the optional oxide 56 (which would correspond to the insulation spacer) is also taught, column 3 line 49-67. The use of this oxide although not shown in other embodiments would have been met given the teachings at column 3 lines 21-25 or alternatively, it would have been obvious to one skilled in the art to have included such liner as taught therein. Regarding the feature in claim 6 of at least one side surface such would have been obvious as shown on the side surface of lines 58 as depicted in Figs. 14-16. Regarding claim 7, the side surface of the dielectric material, e.g., layer 78, in contact with the side surface of the lines is shown in Figs. 15. Regarding the recitation of a single first dielectric and a single second dielectric, such would read on any dielectric under and over the plurality of conductive lines since the claim language "comprising" does not preclude the inclusion of additional dielectric. Such dielectric would correspond to the layer 66 and 64 in Jeng '303 and further would have been obvious as corresponding to conventional single first dielectric and single second dielectric as shown in admitted prior art Fig. 1 layers 14 and 21 and does not require any inventiveness and thus would have been conventional and does not impart any advantage, see e.g., specification page 3 lines 15-16, page 9 lines 12-13. Alternatively, it would have been obvious and would have been within the purview of one skilled in the art in practicing Jeng '303 to have omitted the additional layer(s) and to have employed such single dielectric layer where the function of the additional insulating layers is not desired or required; see *In re Larson*, 340 F.2d 965, 144 USPQ (347 CCPA 1965). and 16. Furthermore, such obviation of the additional insulating layers would have been obvious as shown in Jeng '303, column 6 line 54 to column 7 line 26 wherein it is

contemplated the case of the single dielectric layer on the semiconductor substrate followed by the plurality of conductive lines as well as the case of additional insulating layer between the first layer and the plurality of conductive lines. Regarding the conductive material being a "two layer" conductive material, this corresponds to the conventional multilayer conductive material, e.g., an aluminum layer having a cap layer of TiN, as delineated in Jeng, column 3 line 21. Alternatively, such would have been obvious as shown in Hyakutake, column 3 line 12-17, wherein the inclusion of the cap layer of TiN is conventional and advantageous to facilitate patterning. The inclusion of a underlying barrier, e.g., to form TiN/Al/TiN if desired would have been conventional and obvious; alternatively, it would have been obvious to obviate reciting such barrier if not desired or required.

Claims 14, 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeng '303 singly or with Hyakutake.

Jeng '303 shows conductive lines 62/58/60 on silicon oxide 66 and 64, low k dielectric material 78 located between adjacent lines 58, the upper surface of layer 78 being higher than the upper surface of line 58, and the lower surface of layer 78 being lower than the lower surface of line 58, as shown in Figs. 14-16, column 5 lines 33 to 56, column 6 lines 35-36. The provision of the upper layer of refractory metal nitride and of the optional oxide 56 is also taught, column 5 line 49-67. The use of this oxide although not shown in other embodiments would have been met given the teachings at column 3 lines 21-25 or alternatively, it would have been obvious to one skilled in the art to have included such liner as taught therein. The oxide not in contact with at least one

of the side surface of one of the lines would have been obvious wherein a deposition method having poor step coverage is employed, e.g., specification page 12 lines 6-8 and does not require any inventiveness or result in any advantages. Regarding the recitation at least one side surface such would have been obvious as shown on the side surface of lines 58 as depicted in Figs. 14-16. The limitation regarding the silicon oxide on the titanium nitride not in contact with the side surface of the lines since the silicon oxide that is on the silicon oxide on the line 58 at portion adjacent layer 78 is in contact with the side contacting the layer 78. The inclusion of the oxide between the lines 58 and adjacent dielectric in structures shown in Figs. 16-19 would have been further obvious as evidenced by layer 56 which corresponds to the incorporation of the optional liner delineated at column 3 lines 11-26. In addition, Hyakutake shows the formation of the subsequent dielectric to on the gap filling dielectric, Figs. 3-5 wherein the silicon oxide 107a is provided over the lines 109, followed by the provision of dielectric 108a including planarization by etch back to provide flat surface prior to depositing upper dielectric 109a. It would have been obvious to have included optional oxide and the planarization of the gap filling dielectric to the oxide surface prior to completing the subsequent dielectric layer to provide planarization as taught by Hyakutake.

Claims 10 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeng '303 singly or with Hyakutake as applied to claims 6 and 14 above, and further in view of Jeng '493.

Jeng '303 is applied above and does not explicitly recite PTFE as the dielectric material.

Jeng '493 teaches the use of low dielectric constant material 20 between conductive lines 14a-14d comprising polytetrafluoroethylene. See column 1 line 48 to column 2 line 15, column 3 lines 29-65. The dielectric constant between 1 and 3.9 is also taught. See column 6 lines 4-19.

It would have been obvious to one skilled in the art at the time the invention was made to have employed in Jeng '303 the particular PTFE dielectric material or material having low dielectric constant because such use is conventional and advantageous to improve device characteristics, e.g., to reduce line-to-line capacitance.

Claims 12 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeng '303 singly or with Hyakutake as applied to claims 6 and 14 above, and further in view of Homma et al.

Jeng '303 as applied above does not recite all the various conductive materials such polysilicon, aluminum, copper, tungsten, and multiple layers of TiN/Al/TiN, TiN/Al/Ti, W/TiN/Ti, or any combinations thereof.

It would have been obvious and would have been within the purview of one skilled in the art to have employed the materials enumerated since such correspond to typical aluminum material or other conventional conductive materials as acknowledged in the specification pages 17-19, and since such substitution of well known conductive materials is well within the purview of one skilled in the art as evidenced by Homma et al., column 5 lines 21-25. Copper is a well-known conductive material and its use in the list enumerated would have been obvious.

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 6-18 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-9 of U.S. Patent No. 6,107,686 in view of Jeng '303.

These claims recite a "two-layer" conductive material, including the upper surface having a layer of refractory metal nitride, e.g., claims 6 and 14, and the second dielectric thereon being silicon dioxide. Such would have been obvious over and are encompassed by the limitations in claims 1-15 of '686 as the single conductive material therein would encompass TiN cap as claimed in claim 8 of '686. Additionally, Jeng '303 shows conductive lines 62/58/60 on silicon oxide 66 and 64, low k dielectric material 78 located between adjacent lines 58, the upper surface of layer 78 being higher than the upper surface of line 58, and the lower surface of layer 78 being lower than the lower surface of line 58, as shown in Figs. 14-16, column 5 lines 33 to 56, column 6 lines 35-36. The provision of the upper layer of refractory metal nitride and of the optional oxide 56 (which would correspond to the insulation spacer) is also taught,

column 3 line 49-67. The use of this oxide although not shown in other embodiments would have been met given the teachings at column 3 lines 21-25 or alternatively, it would have been obvious to one skilled in the art to have included such liner as taught therein. Accordingly, it would have been obvious to one skilled in the art to have employed in the claimed invention the further provision of refractory metal nitride including the oxide thereon since such is conventional and advantageous as taught by Jeng '303 wherein the upper metal nitride would serve as a capping layer and the silicon dioxide layer would serve as conformal liner thereon. The inclusion of a underlying barrier, e.g., to form TiN/Al/TiN if desired would have been conventional and obvious; alternatively, it would have been obvious to obviate reciting such barrier if not desired or required.

Applicant's arguments filed February 5, 2003 have been fully considered but they are deemed moot in view of the new grounds of rejection delineated above regarding the two-layer conductive material wherein the inclusion of a cap layer is conventional and advantageous to facilitate patterning. The previous response to applicant's previous arguments remains applicable and is repeated below. Applicant argued that the instant application has fewer elements as shown in instant Fig. 8 and requires less fabrication than Jeng '303 which teaches multiple layered metal line and that Jeng '303 does not teach or suggest the structure where the conductive lines have refractory metal nitride on the upper surface but not on the lower surface thereof. Nonetheless, the instant lines clearly encompass such structures; the deletion in claim 12 does not affect the scope of claim 6, however, and clearly evidences that the multilayer is

encompassed in the claimed process. Regarding claim 7, applicant argues that a spacer thereon now is recited in claim 7. Such claimed language however does not distinguish over the insulating pattern shown in Jeng which would correspond to such spacer as well. The specification further appears to have failed to define or characterize such spacer.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Quach whose telephone number is 703-308-1096. The examiner can normally be reached on M - F from 9 to 5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Wael Fahmy can be reached on (703) 308-4918. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9318 (Before Final) and (703) 872-9319 (After Final).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

A handwritten signature in black ink, appearing to be 'TW' or similar, located at the bottom right of the page.